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ABSTRACT

One in a series of core instructional materials for apprentices to use during the first or second years of apprentice-related subjects training, this booklet deals with basic safety. The first section consists of an outline of the content and scope of the core materials as well as a self-assessment pretest. Covered in the four instructional chapters included in the booklet are handling and storing materials safely, using tools and equipment safely, using ladders and scaffolding safely, and using protective devices and clothing. Each chapter contains an overview; an introduction and objectives; principles, examples, and applications; additional information; and self-test exercises. Appended to the booklet are answers to the self-assessment pretest, answers to the self-test exercises, a posttest, and answers to the posttest. (MN)

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BASIC SAFETY II

Apprentice Related Training Module

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Table of Contents

Glossary iii

1. How To Use The Booklet

What Is This Series About? 1
What Is This Booklet About? 1
What Must I Do To Complete My Work In This Booklet 2
How Much Do I Know About The Subject As I Begin? 2

2. Handling And Storing Materials Safely

Chapter Overview 6
Introduction and Objectives 6
Principles, Examples and Application 7
Additional Information 10
Self-Test Exercises 11

3. Using Tools And Equipment Safely

Chapter Overview 12
Introduction and Objectives 12
Principles, Examples and Applications 13
Additional Information 17
Self-Test Exercises 18

4. Using Ladders And Scaffolding Safely

Chapter Overview 19
Introduction and Objectives 19
Principles, Examples and Applications 20
Additional Information 23
Self-Test Exercises 23

5. Using Protective Devices And Clothing

Chapter Overview 24
Introduction and Objectives 24
Principles, Examples and Applications 25
Additional Information 33
Self-Test Exercises 35

6. Appendix

Answers to Pretest 36
Answers to Self-Test Exercises 36
Posttest 38
Answers to Posttest 40

Glossary

The words on this list are used in this booklet. Please review the terms and learn the definitions. The meaning of the words in the text may not be the form of the word with which you are familiar.

Words/Terms

1. *Appendage* Your arm or leg, as part of your body.
2. *Center of gravity* The point at which the entire weight of an object is balanced so that it would remain in equilibrium in any position.
3. *Corrosive* The process of eating away or weakening by chemical action.
4. *Ground/Ground wire* Device that carries electrical leakage away from tool user.
5. *Ladder braces and spreaders* The wooden or metal materials on a step ladder that permit you to open the ladder and that holds the two sides together.
6. *Obstruct* To block.
7. *Safety cleat* A chuck at the foot of a ladder to keep it from slipping.
8. *Shock load* Sudden change in stress on a rope caused by suddenly adding a load to a slack line or by changing speed of a lift load.
9. *Tiers* Layers in stacking materials.
10. *Vulnerable* Susceptable or at risk for something to happen.

1. How To Use This Booklet

What Is This Series About?

Basic Safety II is one of ten booklets written as core instructional materials for apprentices to use during the first or second years of apprenticeship related subjects training. Nine of the booklets are about critical subject areas for apprentices, as determined by a national group of experts on apprenticeship and training. The tenth booklet introduces the other booklets and explains how to use the materials in the instructional setting.

The materials are designed to be used with other related subjects instructional materials. They can be employed in one of two ways: (1) the materials can be used as the total instructional materials package for some trades, in subjects such as basic science, measurement, and working in organizations; or (2) they can be used as supplementary, introductory or practice materials in subjects such as basic mathematics, safety and an introduction to apprenticeship.

The booklets are written in a self-instructional, self-paced format. They can be used either in instructor supervised or independent study arrangements. *Each booklet and each chapter is written as a distinct unit and is addressed to a single major topic.* This means that you or your instructor can select individual booklets or chapters without necessarily using every booklet or every chapter within a booklet.

The booklets emphasize application of facts, concepts and skills. Material is presented by means of written information, visual illustration and applied example. The discussion for most major topics also includes an application section that requires you as a learner to demonstrate what you are learning. In addition, each chapter contains a section entitled Self-Test Exercises that contains questions, problems and exercises for you to work through as a final application of the knowledge or skill and to show that you have mastered the materials.

The titles of the booklets in the core materials are:

1. *A Basic Core Curriculum*
2. *Introduction to Apprenticeship*
3. *Basic Mathematics*
4. *Basic Safety I*
5. *Basic Safety II*
6. *Basic Measurement*
7. *Sketching, Drawing and Blueprint Reading*
8. *Basic Physical Science*
9. *Working in Organizations*
10. *Interpersonal Skills and Communication*

What Is This Booklet About?

Basic Safety II deals with specific situations that involve safety consideration and care on the work site. The hazards, rules and situations described in this booklet are the most frequent cause of

accidents and injury on the job. When you have completed your work in this booklet, you should have a basic elementary knowledge of how to use safely the tools and equipment discussed in this module. The specific topics addressed in this set of materials are:

1. Handling and Storing Materials Safely
2. Using Tools and Equipment Safely
3. Using Ladders and Scaffolding Safely
4. Using Protective Devices and Clothing

What Must I Do To Complete My Work In This Booklet?

Working your way through this booklet will require you to read the text, to answer the questions, to perform the exercises and to complete the pretest and posttest instruments. Expect to spend about five hours working through the materials. The only resources you need to complete your work in this booklet are: (1) a copy of the booklet; (2) a pencil or pen; and (3) about six hours of time.

The materials are written in a self-instructional, programmed format. You may work through the text, examples, and questions at your own pace and leisure. You need not complete your work in the booklet at one sitting.

Each chapter in the booklet is devoted to a single skill, competency or unit of knowledge. The general format of the chapters is similar, with the following parts.

1. A *chapter overview* containing all the necessary information you need to know in order to work through the chapter.
2. An *introduction* describing the knowledge or skill and the instructional objectives for the information.
3. *Principles, examples, and applications* presenting and explaining the content as well as offering you practice opportunities to apply the information.
4. Additional *sources of information.*
5. A *self-test exercise* for applying the information under consideration.

This booklet concludes with an appendix that contains the answers to the pretest, the self-test exercises from each chapter and the posttest.

How Much Do I Know About The Subject As I Begin?

Begin your work in *Basic Safety II* by completing the self-assessment pretest that follows. When you have completed the pretest as directed in the assessment instructions and have finished reading the other material in this introductory section, continue your work in this booklet, one chapter at a time. Begin with Chapter 2 unless the results of your self-assessment indicate that you should do otherwise.

In each chapter, do the following:

1. Read:
   - Background information.
   - Steps and procedures for performing skilled activities and explanations of major points and ideas.
   - Examples illustrating use of information, performance or skills, or application of materials.

2. Consider the questions and exercises in the text. Work the questions and check your answers.
3. When you believe that you have mastered the material, take the Self-Test at the end of the chapter.
4. Check your answers with those provided in the Appendix at the end of the booklet. If you achieve at least the minimum acceptable score, move to the next chapter. If your score is below acceptable levels, work through the chapter again.

Self-Assessment Pretest

Directions: The self-assessment will help you focus on specific strengths and limitations of your safety knowledge and skills. Select the best answer for each question and record it in the appropriate space. After you have worked through the entire pretest, score your test following the directions at the bottom of the test.

1. Circle the letter of the item that identifies the most frequent cause of injury on the job.
   a. Inappropriate ladder and scaffolding use.
   b. Using hand tools unwisely or inappropriately.
   c. Failing to use appropriate protective clothing.
   d. Inappropriate handling and storing materials.

2. When you lift a load, the greatest stress should be on your:
   a. back
   b. legs
   c. shoulders
   d. neck and arms

3. Place in order the steps in moving a load manually.
   ____ a. Assume comfortable stance with feet close to load.
   ____ b. Hold load close to body with weight evenly distributed and walk with even gate.
   ____ c. Return load to floor or platform in similar fashion to that of picking up load.
   ____ d. Rise slowly, lifting load by straightening legs with stress on legs and shoulders.
   ____ e. Size up load to determine appropriate weight and desirable lift point.
   ____ f. Grasp load securely, take and hold deep breath and tuck chin.
   ____ g. Crouch or squat close to load with knees bent and back straight.

4. Which of the following activities or considerations must you attend to before handling materials or moving a load?
   a. Hold the load so that the weight is evenly distributed.
   b. Check and clear the area where the load will be set.
   c. Avoid wearing clothing that is loose fitting.
   d. Yield to other traffic at blind corners.

5. When stacking or piling sacks of materials, at what layer should you begin to "step-in" bags from the edge for safety purposes? Answer: _____

6. When using a manual hand truck or dolly, where should the load be placed? Answer: _____

7. What are two sources of information on how to operate a power tool safely? Answer: _____ and _____

8. What is the hazard of using power tools in wet areas? Answer: _____
_____

9. List three things you should check for in inspecting power tools and equipment?
   a. _____
   b. _____
   c. _____

10. What should you do before cleaning or making adjustments to a tool or equipment? Answer: _____

11. How do you develop an awareness of risks and hazards in your job? Answer: _____
_____

12. How far must the planks of a scafffold overlap to be considered safe? Answer: _____

13. How far should the base of a ladder be placed from the base of the wall against which it is leaning?
   a. Twenty percent of height of ladder.
   b. Thirty percent of working length of ladder.
   c. Twenty percent of working length of ladder.
   d. Twenty-five percent of working length of ladder.

14. Scaffolds should be able to support at least _____ times the amount of weight they are expected to hold.
   a. Eight times
   b. Six times
   c. Four times
   d. Two times

15. Circle each item that is a condition when a step ladder should *not* be used.
   a. When the brace between legs is less than fully extended
   b. When leaning against a wall as a straight ladder is used
   c. When the legs are on different levels
   d. When the ladder has a broken rung

16. Which of the following are *not* effective to protect your eyes from flying particles?
   a. Safety glasses
   b. Contact lenses
   c. Chipping goggles
   d. Laboratory goggles
   e. Face shield

17. List two types of protection against hazardous noise on the job:
   a. _____
   b. _____

18. Which of the following is *not* a guideline for wearing safety clothing:
    a. Wear pants with cuffs to protect against materials falling in your shoes.
    b. Wear close-fitting clothing to protect from equipment moving parts.
    c. Wear flame retardant clothing to protect against sparks.
    d. Wear plastic or rubber gloves to protect against corrosive materials.

19. What protective equipment should be worn on a construction site? Answer: _____ and _____

20. Explain the difference between air purifying respirators and air supplied respirators. Answer: _____

_____

_____

Scoring: Check your answers with those provided in the appendix. Mark each answer right or wrong. Then, grouping the answers into the set of questions listed below, count the number correct for each set. Enter the amount in the appropriate spot on the Chapter Overview Chart that introduces each chapter, beginning with Chapter 2.

Questions 1-6, number correct is _____
Questions 7-11, number correct is _____
Questions 12-15, number correct is _____
Questions 16-20, number correct is _____

2. Handling And Storing Materials Safely

Chapter Overview

Purpose:	To insure that each apprentice knows the basic rules for handling and storing materials.
Preassessment Score:	Write in the following space the number of correct answers from Pretest questions 1-6: _____. If you answered all 6 of the questions correctly, skip to Chapter 3. If you missed one or more questions, continue to work in this chapter.
Prerequisites:	Chapter 1 of this booklet.
Resources:	Time — A minimum of 75 minutes to completion. Materials — pencil.
Performance Statement:	At the conclusion of your work in this chapter you will recall and identify safety rules and hazards associated with handling and storing materials.
Performance Measure:	A fifteen-minute paper and pencil posttest to be taken after completing the entire booklet.
Standards:	To be successful, you must answer at least 90% of the Posttest items correctly.
Activities:	1. Read the text, examples and illustrations and commit information to memory. 2. Work questions, examples and problems. 3. Complete and check the self-test exercises and posttest.

Introduction And Objectives

Activities associated with handling and storing materials result in the greatest number of accidents and injuries on the job for any single set of job activities. As many as 25 percent of job injuries — and probably an equally high percentage of injuries at home — are a direct result of inappropriate materials handling techniques. Further, most of these injuries are avoidable or preventable if you think ahead and observe several basic safety rules.

In this chapter you will consider and commit to memory the basic rules for handling and moving materials manually and as aided by common moving equipment. When you have completed your work in this chapter you will demonstrate your competence by being able to:

1. Recall and list the more important considerations that you must take into account before moving materials;
2. Describe and demonstrate the proper procedures for lifting and carrying materials by hand;
3. Identify safety rules for using moving equipment like hand trucks; and
4. Identify and critique general rules for storing various types of materials.

Principles, Examples and Applications

General Steps Before Moving Materials

Do you recall the last time that you slipped or stumbled across an uneven surface while carrying a load? Do you remember cutting, scratching or scraping your hands or arms when carrying a load that was a "tight fit" in the area in which you were working? Do you remember either having your load slip or shift while you carried it or as you set it down? Do you remember ever having moving problems due to slippery hands, slick or uneven surfaces or due to clutter in the area where the load was to be placed? These problems are common; almost everyone has experienced one or more of the difficulties with more or less serious consequences. More importantly, each of these problems could and can be avoided by following several basic guidelines regarding the handling of materials *before you lift the load.* The guidelines are:

1. Check your hands, arms and shoes to make sure they are dry and free of slick substances. If necessary, wash or wipe hands clean and dry. Wear gloves if necessary to improve grip.
2. Check the materials you will lift for sharp or jagged edges. Smooth edges, lift using other surfaces, and wear gloves to avoid problems.
3. Check the surface over which you will carry the load for slick or rough spots and for uneven areas. Avoid these areas or correct the problem. Equally important, clear away any materials in your path that could cause you to trip, stumble or fall.
4. Check the area through which you will carry the load to be sure the load will fit. Sometimes you will need to rearrange materials, disassemble the load you must move, or select an alternative route in order to fit your load through the available space.
5. Check the area to which you will move the load. Clear an area in which to place your load.

You can avoid the basic problems associated with the materials and the area by considering these guidelines and taking appropriate action. You can reduce the risk of an accident even more by exercising great care in lifting and carrying materials.

Methods For Lifting And Carrying Materials

Worker error rather than materials problems causes most accidents and injuries in the area of materials handling. Trying to lift or carry too heavy a load, or trying to carry a heavy load too far, or lifting a heavy load incorrectly can cause serious strains, dislocations, sprains and hernias. You must know your safe lifting and carrying limit and must not exceed that limit. Equally important, there is a right way and a wrong way to lift. You must learn and use consistently the right way in order to avoid injury. Read and learn the following steps in lifting and carrying the right way:

Step 1:

Size up the load in order to determine its approximate weight. Also decide from what position, angle or side you can most easily lift the load.

Step 2:

Assume a comfortable stance and position that will enable you to lift as straight-up as possible. Position your feet close to the load with one foot directly beside the load and the second foot slightly behind the first. Your feet should be spread apart about as wide as your shoulders.

Step 3:

Crouch or squat close to the load with your knees bent and your back straight. Kneel if necessary.

Step 4:

Grasp the load in a comfortable, secure hold. Take a deep breath and hold it. Tuck your chin and prepare to lift.

Step 5:

Rise slowly, lifting the load as you go. Lift the weight by straightening your legs. Place the strain of lifting on your legs and shoulders, not your back. Do not twist or shift the load as you stand.

Step 6:

Hold the load close to your body and carry the weight so it is evenly distributed. Walk at your normal pace. Do not let your view be obstructed by the object.

Step 7:

Place the load on the floor similar to the way you picked it up. Hold the load close to your body and bend your knees to lower the load. Hold your back straight. Make your legs and shoulders support the weight. If you are placing your load on a platform, table or dock, place the front edge of the load on the platform, letting the platform take part of the load. Then push the load the rest of the way onto the platform.

Do not hold the load awkwardly, or twist, or strain. Most importantly, do not lift more weight than you know you can handle. Hold the materials so that the load is comfortable. For example, carry sacks and cartons on your shoulder to prevent back strain; avoid carrying heavy loads in front of you and always carry the load close to your own body and center of gravity.

Rules For Using Manual Handtrucks And Dollies

Handtrucks, dollies and wheelbarrows are equipment frequently used to move materials. The devices are useful, uncomplicated and safe as long as you observe several basic safety rules. For example, place your load in the center of the vehicle with its weight evenly distributed upon the axle with a low center of gravity. Poorly loaded equipment can tip over, get out of control, or drop the load. When possible, rope or chain the load to the equipment.

When moving the loaded equipment, stand behind the handtruck or dolly to avoid being trapped or run down by the load in case it gets away while going downhill. Avoid uneven surfaces that may cause the load to tip and never pile the load so high as to obstruct your view when moving the equipment.

In addition, before moving materials using equipment, inspect the area and load using the general guidelines for moving loads. Be especially mindful of inspecting for clearance along the route over which you will move the materials. Many smashed hands and crushed fingers and arms result from accidents that occur due to inappropriate attention to these items.

Give special attention to operating powered industrial and handtrucks. Always proceed with caution, yielding at blind corners and to other traffic. Do not place yourself between the equipment and a wall or load. Too often carelessness about placing yourself between the equipment and the wall results in crushed ribs or appendages. The general rules for using manual equipment also apply to using powered forklifts and other similar equipment. Be mindful to avoid unsteady or unevenly distributed loads as well as uneven or broken road surfaces over which to move. Drive slowly. When parked, place the gears in neutral, and lower the lift portion almost to the ground and shut off the power source.

Working With Conveyors And Hoists/Slings

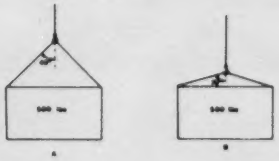
Conveyors and hoists are powered machines used frequently in industry to move larger amounts of materials. Safety is essential around these machines. The emphasis is on prevention. Rules for working with and around conveyors are:

1. Avoid wearing loose or ill-fitting clothing or working too close to the conveyor. Do not get snagged by material on the belt.
2. Avoid allowing the equipment you are using, your hands or your clothes, to become caught in the nip-point where the belt and roller meet.
3. Rig guards on the conveyor to prevent materials from falling into work areas or onto workers.
4. Be sure that conveyors are fitted with emergency devices to stop the belt as well as with locks to shut down the system.
5. Avoid playful activity around conveyors and always wear life-lines when working near the entrance of a chute.

Hoists and slings frequently are used to lift heavy loads. They involve cables or ropes, pulleys and often motorized wenches. You must be concerned especially with the rope or cable used with the hoist or sling. Usually wire rope is preferable, especially for permanent applications. Fiber ropes require special care and inspection. Avoid using any fiber rope that is brittle, discolored, or dirty on the inside. Wire ropes are stronger and longer lasting than fiber ropes. Further they do not change in size or strength with weather conditions.

The rules for using rope for slings and hoists are:

1. Inspect ropes (fiber or wire) frequently to find and eliminate potential problems.
2. Avoid dragging rope in dirt, tying knots or links, and reverse bends.
3. Avoid shock loads or the sudden changes in degrees of stress on a rope caused by suddenly adding a load to a slack line or by changing the speed of the lift load. Shock loads weaken the line. They can be avoided by lifting slowly and steadily while avoiding slack and jerks.
4. Check sling and hoist ropes frequently for breaks, stretches or wear. Use pads, where necessary, on sharp corners.
5. Tie sling so as to prevent stress on ropes. Remember, the greater the angle of the sling legs, the greater the stress on the sling. The ropes in Sling A are under much less stress than the ropes of Sling B.



Piling And Stacking Materials

Have you ever experienced difficulty in convincing materials to stay where you put them? Perhaps their shapes made them difficult to store in a small space or perhaps weather changes affected their storage ability. Regardless of the problem, you can improve your chances of storing materials successfully if you follow several rules. These include the following:

Sacked Materials

1. When storing sacked materials, stack sacks not more than 10 sacks high.
2. Store sacks on outer tiers of stack with the mouths of the bags facing the center of the pile.
3. Keep pile even when removing sacks.
4. Wear protective clothing if stacking hazardous materials.
5. Check strength of floor or surface on which materials will be stacked.
6. Cross pile base into separate tiers and step-in bags away from the edge for each row of sacks above 5.

Lumber

1. Stack by size on level cross pieces.
2. Use cross strips when pile is more than 3 feet high.

Pipe

1. Store in racks or block to prevent from rolling.

Brick and Tile

1. When stored in stacks over 4 feet high, step in one to two inches for each 6 inches above four feet.
2. Limit piles to 6 feet in height.
3. Carry in flat wheelbarrows to avoid chipping after unloading stack so that top of stack stays relatively level.
4. Never store on scaffolds or in runways.

Additional Information

For additional information on handling and storing materials you may wish to read sources such as:

Manual of Accident Prevention in Construction. Washington, DC: The Associated General Constructors of America, Inc., 1949.

Safety and Health Series. Waco, TX: Center for Occupational Research and Development; 1982.

Self-Test Exercises

Read and answer the following questions. Check your answers with those in the Appendix. If you answer less than all 6 items correctly, repeat your work in this chapter. If you score 6 correct items, go on to the next chapter.

1. List the seven steps for properly lifting, carrying and setting down a load.
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____
   f. _____
   g. _____

2. What set of five things must you check before moving any load?
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____

3. When stacking sacked materials, what is the maximum safe height in number of layers?
   Answer: _____

4. What factors cause the greatest stress on ropes or cables used in hoists or slings?
   Answers: a. _____ b. _____

5. What kinds of clothes are prohibited around conveyors?
   Answer: _____

6. Where should you position yourself when using equipment to move material? Answer: _____

3. Using Tools And Equipment Safely

Chapter Overview

Purpose:	To develop knowledge and skills in the safe use of tools and equipment. An apprentice will learn about the hazards involved in using tools and equipment and how to avoid equipment or tool related accidents.
Preassessment Score:	Write in the following space the number of correct answers from Pretest questions 7-11: _____. If you answered 5 of the questions correctly, skip to Chapter 4. If you missed any questions, work through this chapter.
Prerequisites:	Chapter 1 of this booklet.
Resources:	Time — about 60-90 minutes to complete. Materials — paper
Performance Statement:	At the conclusion of your work you will identify hazards and safe work procedures associated with tools and equipment.
Performance Measure:	A fifteen-minute paper and pencil Posttest to be taken after completing the entire booklet.
Standards:	To be successful, you must answer correctly 90% of the Posttest items.
Activities:	1. Read the text, examples and illustrations and commit information to memory. 2. Work exercises and answer questions. 3. Complete and check your answers on the Self-Test Exercises and the Posttest.

Introduction And Objectives

Accidents resulting from the unsafe use of tools or equipment can be particularly serious. Shocks from faulty tools can cause burns or even death. Unsafe operation of power equipment can lead to minor loss time accidents as well as such serious disabilities as loss of an arm or your life. A worker who is not adequately trained in the use of tools is particularly susceptible to these hazards. But even the well-trained worker has accidents resulting from carelessness, inattention or boredom. This chapter will help you to avoid accidents in the workplace by using tools and equipment safely. After completing this chapter you will be able to:

1. Recognize unsafe work situations involving tools and equipment.
2. List safe work practices for using tools and equipment.
3. Recognize the consequences of unsafe work habits.
4. Identify how to develop safety skills.

Principles, Examples And Applications

Tools and equipment are designed to modify materials through the use of force. This may involve a very simple operation such as driving a nail with a hammer. On the other hand, the operation may be more complex such as the turning of a metal rod under numeric control. No matter how complex the operation, the fact that use of tools and equipment involves some type of force puts you in danger. For example, through carelessness, the force from a hammer could be transmitted to your thumb rather than the nail head. Power tools and equipment impose more serious hazards. Moving parts, such as in running gear wheels, revolving shafts, driving motors and belts, blades and punches, all are potential dangers.

Power tools have the added hazard of electrical shock. On high-voltage equipment or in a wet environment, shocks can be deadly. Low-voltage shocks can also be serious by indirectly causing an accident, such as a fall from a scaffold. Safeguards against shock are generally built into tools and equipment. But you as a worker must be responsible for assuring electrical safety. Electrical safeguards include:

1. Use a ground wire: This assures that electrical leaks go to ground through a wire rather than the tool user. This requires a three-prong outlet and extension.
2. Use low voltage: if a shock occurs, it is of lower intensity.
3. Use double insulated construction: This completely insulates the user from electrical current. There is no need for a ground wire.

Most modern equipment has built-in guards to protect the worker from mechanical hazards. These range from a trip switch to automatically shut-off equipment, to screens that prevent fingers or other body parts from entering hazardous areas, to automatic guards which push a worker out of the way of moving parts. The design of the job also can counteract hazards. For example, devices other than hands can be used to feed material into machines for processing. Even so, it is still up to you to follow such operating procedures and to ensure that guards remain in place and are operating properly. By becoming aware of the risks in your work environment you take the first step in being a safe worker.

Safe Work Practices

Each different tool or piece of equipment has proper and safe procedures for operation. For example, a wrench should be pulled toward you rather than pushed away from you to use it safely. Likewise, an adapter should not be used to connect a grounded plug to a two-pronged outlet. The following guidelines are some general safety procedures and sample consequences of not following the guidelines. Before using a tool or equipment you should find out about its safe operation from your supervisor, safety notices, manufacturers' operating and maintenance instructions and manuals.

Table 1: Safe Work Practices For Using Hand Tools

Safety Guidelines	What Could Happen If You Do Not Follow Guidelines
1. Keep tools in good condition — clean, oiled, free from rust, cracks, chips.	Tools in bad condition can break, slip or perform poorly. This can cause you to hurt yourself — for example wrenching your back when a tool slips. Or the tool itself can cause injury as in the case of a sledge hammer head that flies off a broken handle.
2. Store tools in a safe place.	Tools not put away can be used by someone not trained in their use. They also can get in the way of an unaware worker. For example, a wrench left in the wrong place can cause someone to trip or it can fall on someone's head.
3. Select the proper tool for the job.	Using the wrong tool can cause the tool to break, slip or perform poorly. You also can strain a muscle or sustain another body injury by using the wrong tool.
4. Use tools correctly.	Using a tool incorrectly can cause an injury to you or a co-worker. For example, many injuries occur from people cutting toward themselves rather than away when using a blade.
5. Use a tool box, cart, belt or pouch to transport tools, instead of in pockets or hands.	You may need your hands to help you maintain your balance on a ladder or scaffold. Tools in pockets can cause a puncture or other injury.
6. Hand tools to co-workers rather than throwing them.	The tool may hit the co-worker causing an injury or he/she may lose their balance reaching to catch a tossed tool.

Table 2: Safe Work Practices For Using Power Tools And Equipment

Safety Guidelines	What Could Happen If You Do Not Follow Guidelines
1. Inspect tools and equipment periodically. Check: — That the motor is operating smoothly — That guards are in place and operating freely — That tools and equipment are clean, lubricated and sharpened — The condition of cords, plugs, and insulation, for cracks, breaks, loose connections — That controls operate and release correctly — That parts are not loose or missing — That the workhead moves freely by hand when unplugged	For tools to operate properly they must be in proper condition. Any number of accidents can occur from not inspecting and maintaining tools, including electrical shock, fire, and bodily injuries from tool malfunctions.
2. Maintain tools as needed and directed in manufacturer's instructions, including cleaning, lubricating, sharpening, and any minor repairs for which you are trained. Have other problems fixed by a trained service person.	
3. Store tools where they are protected and out of the way.	Misplaced tools can be damaged or cause injury by falling on someone or getting in the way.
4. Do not hang cords over nails or other sharp edges or leave them loose on the floor.	Insulation can become damaged causing a potential for shock. Someone can trip on a cord in the floor.
5. Use the correct tool for the job: — Use proper size tool — Use proper duty rating of tool — Use proper accessories (bits, blade, disks, etc.)	An improper tool or accessory will not do the job as efficiently. Also, jamming or over working can cause the tool to break causing shock or other injury.
6. Follow standard operating procedures in using tool.	A shock or other injury can result from using a tool improperly.

Table 2: Safe Work Practices For Using Power Tools And Equipment (Continued)

Safety Guidelines	What Could Happen If You Do Not Follow Guidelines
7. Turn off and unplug tool before cleaning or making adjustments.	A surprise start-up of a tool can directly cause an injury or indirectly cause you to hurt yourself by startling you.
8. Wear required protective materials (gloves, shields, goggles, shoes, etc.)	Flying particles or objects can injure unprotected parts of your body.
9. Use low-voltage tools in wet areas.	Wet objects conduct electrical current much better. Thus, you are much more prone to a serious shock when wet. By using low-voltage tools you limit the intensity of a shock.
10. Use correct size fuses.	If a fuse does not cut off when it should, you can be shocked.
11. Use correct voltage.	A tool/machine operating at a speed it is not designed for operates inefficiently and can even burst at high speed.
12. Secure the piece you are working on.	While holding the piece in one hand and operating a tool in the other, it is easy to lose your balance and more difficult to react to unexpected occurrences.
13. Keep the work area clean.	It is difficult to walk in, see in and work in a messy work space.
14. Do not wear loose clothing, jewelry, long hair when operating tools and equipment.	Loose objects can easily become entangled in a tool head or motor, drawing you into a dangerous or deadly area.
15. Walk only in designated aisles or passageways. Keep these areas open.	Walking in non-passage areas exposes yourself to hazards. You may also interfere with someone else's work by being in the wrong place and cause them to have an accident.

Exercise

Make a check list of the guidelines listed above. Check your work practices for a one-week period. How many of the practices did you follow in using tools and equipment? Did you perform any of the activities in an unsafe manner? What were the consequences? What could have happened?

Developing Safety Skills

Whenever you work with tools or equipment you are exposed to a number of hazards. By developing safety skills you can reduce the impact of these hazards. Follow three steps to develop safety skills in working with tools and equipment:

1. *Develop an awareness of the risks and hazards.* Evaluate your work environment to determine what types of hazards exist. Find out about the tools and equipment. What are the moving parts? How are the machines guarded? How do these guards work? Where and how have accidents occurred in the past? Look for any work practices or situations which appear to be dangerous. Make notes of the hazards and think about them so that they are always in the back of your mind when working. This way you will be ready for the unexpected.
2. *Learn to operate, adjust, and maintain tools and equipment safely.* Find out specific operating procedures through on-the-job training, from your supervisor and co-workers. Find out who has the best safety record and watch how they operate tools and equipment. Make a list of the applications and limitations of your tools and learn them. Finally, practice using tools and equipment under supervision until you have mastered safe operating procedures.
3. *Be alert.* Many accidents are caused by carelessness. Pay attention to what you are doing, while keeping aware of the job hazards. Be alert to any changes in sound, vibration, operation, or feel of your tools and equipment. Most of all, respect them.

Additional Information

For additional information you may wish to read:

Accident Prevention Manual for Industrial Operations, Seventh Edition. Chicago, IL: National Safety Council, 1974.

Manual of Accident Prevention in Construction. Washington, DC: The Associated General Contractors of America, Inc., 1949.

Safety and Health Series. Waco, TX: Center for Occupational Research and Development, 1982.

Self-Test Exercises

Read and answer the following questions. When finished, check your answers with those provided in the Appendix. If you score 7 or 8 correct answers, move on to the next chapter. If you answer less than 7 items correctly, repeat your work in this chapter.

1. **What are two major types of hazards in using power tools and equipment?**
   a. _____
   b. _____

2. **List three conditions that increase the chance of electrical shock when working with power tools.**
   a. _____
   b. _____
   c. _____

List three things you should check when inspecting a power tool:

3. _____
4. _____
5. _____

What are the three steps to developing safe working skills?

6. _____
7. _____
8. _____

4. Using Ladders And Scaffolding Safety

Chapter Overview

Purpose:	To insure that each apprentice is introduced to the proper procedures and potential problems of ladder and scaffold use.
Preassessment Score:	Write in the following space the number of correct answers from Pretest question 12-15: _____. If you answered all 4 of the questions correctly, skip to Chapter 5. If you missed one or more questions, continue to work in this chapter.
Prerequisites:	Chapter 1 of this booklet.
Resources:	Time — A minimum of 60 minutes to completion. Materials — pencil
Performance Statement:	At the conclusion of your work in this chapter you will recall and identify safety rules and hazards associated with using ladders and scaffolding.
Performance Measure:	A fifteen-minute paper and pencil Posttest to be taken after completing the entire booklet.
Standards:	To be successful, you must answer at least 90% of the Posttest items correctly.
Activities:	1. Read the text, examples and illustrations and commit information to memory. 2. Work questions, examples and problems. 3. Complete and check the self-test exercises and posttest.

Introduction And Objectives

Use of ladders and scaffolds is one of the major hazards on the construction job site. Hazardous conditions include improperly securing the ladder, scaffold or bracing; broken or substandard materials; and errors in ascending or decending. Most ladder and scaffold accidents are preventable if you exercise care and good judgment before using the equipment. In this chapter you will learn about ladder hazards and safety as well as a set of general rules that apply to the use of scaffolding. When you have completed your work in this unit you will be able to:

1. Recall and identify typical hazards associated with ladder and scaffold use; and
2. Suggest appropriate safety procedures for using ladders and scaffolds.

Principles, Examples And Applications

Ladder Hazards And Safety

Ladders are tools that are abused too frequently on the job, with very serious results. Carelessness and ignorance result in thousands of work-related ladder accidents each year, hundreds of which have permanent outcomes. The vast majority of such accidents and injuries are avoidable if you are aware of ladder hazards and if you know and practice ladder safety. Remember, ladders of some type are used in most apprenticeable occupations and only *you* can be responsible for your own safety.

Before using a ladder, always check for loose or missing rungs; broken sides, braces, or spreaders; and poor stability. If a ladder has these problems, *do not use it*. Find another ladder. Be particularly wary of painted wooden ladders because the paint can conceal dangerous faults in the wood.

Be sure that all rungs of the ladder are parallel and level to the ground. No rung should be more than 12 inches from any other rung and the ladder should be about a foot wide. Do not stand on the top rung of a ladder; instead, use a longer ladder. Also avoid climbing on the ladder braces and be sure that, if you are using a step ladder the legs are fully extended and locked. Do not use a step ladder leaned against a wall.

The rules for using a ladder may vary slightly with the type of ladder. Even so, the general rules apply. Follow these rules for your health:

1. Use only sound ladders. Avoid defective equipment.
2. Use a ladder with safety feet suitable to the surface on which it stands. The bottom should rest on a solid, level surface. If no safety feet or non-slip provisions are available, either nail the bottom of the ladder to the floor or place the bottom of the ladder against a safety cleat. Figure 1 illustrates these techniques.

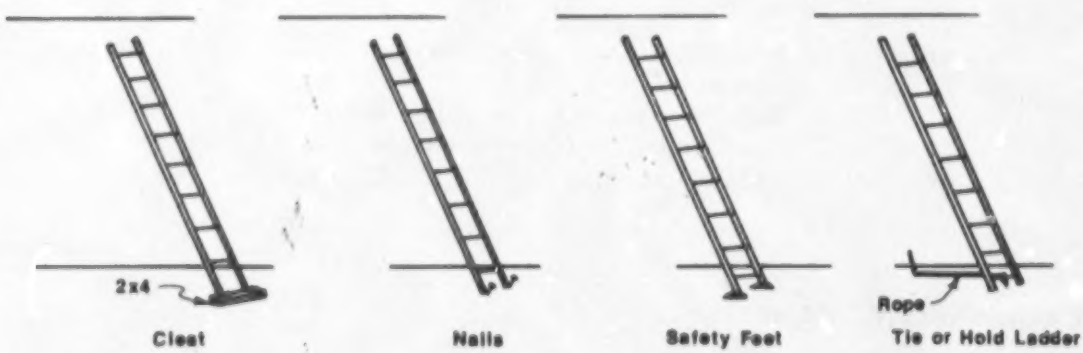


Figure 1: Ladder Bottoms

3. The top of the ladder should extend about three feet above the top of the surface to which you are climbing or above the level on which you are working.
4. Avoid placing the ladder in front of a door or entrance into a structure. If one ladder must be placed in that area, lock or close off the entrance. Never lean the ladder against a window

pane or sash. Always avoid leaning the ladder against stacked materials. Never use a metal ladder around electrical wires.

5. If you use a step ladder, be sure that the ladder is fully extended and locked before you climb.
6. Place barricades or warnings around the base of the ladder to warn passers-by of your presence.
7. Place the ladder against the wall so that the distance of the base of the ladder from the wall is equal to about 25 percent or one-fourth of the working length of the ladder. This means that the base should be set away from the vertical surface one foot for every four feet of working length of the ladder. This will result in an angle between the ground and the ladder of about 75 degrees. Figure 2 illustrates this point.

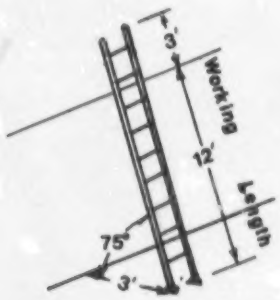


Figure 2: Ladder Placement

If the bottom of the ladder is too close or too far away from the wall, the ladder will either slip or topple backwards. If you feel comfortable and do not have to lean as you begin to climb, the angle is probably correct.

8. As you climb, have another worker hold the ladder. Climb by facing the ladder and holding on with both hands. Carry all tools or materials in comfortable, out-of-the-way tool belts or have them hoisted up to you.
9. Work only a comfortable reach on all sides of the ladder. Do not hesitate to move to a new spot rather than reaching long distances.
10. Do not strap or splice ladders together to make a longer ladder. Instead, use an extension ladder of 60′ or less.
11. The overlap of the sections of an extension ladder is about 10 percent of the extended length of the ladder. Therefore, for a 36′ ladder, the overlap would be at least 3′; for a 40′ ladder it is 4′ and for a 48′ ladder it is 5′. Remember, it is safer to have too much overlap rather than too little. Always make certain the extension section is securely locked.
12. If necessary, brace or secure long ladders in the middle to eliminate the spring and make them more rigid.

In addition to these rules, remember that, especially with extended ladders it usually is a good idea to have someone else help you set up the ladder. First secure the base, then walk the ladder into the air. Also, *always* before climbing, check to be sure the ladder is secure *and* wipe any grease, mud and other materials from your shoes and hands. Further, when climbing on fixed ladders, use a cage or safety belt.

Scaffold Safety

Scaffolds are elevated platforms that support workers and materials. They are temporary; their height is increased as work proceeds vertically and they are removed when work is completed.

In general, scaffolds must be constructed from sound materials placed on a solid base. Further, rails, toe boards and guards should be used to prevent possible injury to those below from dropping objects off the scaffold. Do not build scaffolds on loose materials such as loose brick or stacked materials. Brace all angles and leave no gaps along the floor through which a tool or foot could slip.

General guidelines for erecting and using scaffolds are:

1. Design and build scaffolds to support four to five times the weight you anticipate holding on the scaffold. *Do not overload* the scaffold.
2. Always build scaffolds on firm, solid surface. Use only quality material that has not weathered or been weakened. For example, use long grain wood for flooring. Brace all angles and use an adequate number of supports.
3. Inspect structure of scaffold each day. Clean scaffold of debris and tools each day. Do not store materials on scaffold.
4. Place guard rails and toe boards on any platform above 10′ in height.
5. Overlap plank flooring at least 12″ and never extend a plank more than 12″ - 18″ beyond the end support. Usually planks should rest on supports every 6′ to 8′.
6. Protect and mark scaffolding so that vehicles and equipment moving materials do not hit the structure.
7. Fasten ladders to structure so they cannot slip or fall. When nailing braces and supports, always drive the nails home. Further, when possible, use cut nails to increase holding power.

The specific guidelines for erecting pole scaffolds are:

Light Trades Pole Scaffolds*

Specifications

1. *Uprights.* For heights not exceeding 32′ use 2″ x 4″ lumber or heavier. For heights above 32′ use 4″ x 4″ lumber or heavier.
2. *Ledgers.* Use two 1″ x 6″ boards nailed to either side of uprights, or one 1″ x 8″ board.
3. *Ribbons.* Use 1″ x 6″ board or heavier.
4. *Handrail.* Use 1″ x 6″ board, 1″ x 8″ board or 2″ x 4″. Place 42″ above platform and inside of upright.
5. *Platform.* Use two 2″ x 10″ planks. Overlap at least one foot.
6. *Toe-Board.* Use 1″ x 6″ board, or wider.
7. *Crossbracing.* Use 1″ x 6″ lumber or heavier.
8. *Footblocks.* At least 2″ in thickness.

*From *Manual of Accident Prevention in Construction.* Washington, DC: The Associated General Contractors of America, Inc., 1949.

Heavy Trades Pole Scaffolds*

(Bricklayers, Stonemasons, Concrete Workers, Steel Workers, Etc.)

Specifications

1. *Uprights.*
   a. For heights not exceeding 32′ use 4″x 4″ lumber or larger.
   b. For heights from 32′ to 72′ the first 32′ should be not less than 4″ x 6″ or larger.
   c. Splices on uprights to be at least two 1″ x 6″ pieces 30″ long. Splices to be nailed on all four sides of uprights.

2. ***Ledgers.*** Use two 1" x 6" boards or larger nailed or bolted to either side of upright or one 2" x 6" board.
3. ***Ribbons.*** Directly under ledgers, one 1" x 6" board or larger. Where ledgers are bolted, ribbons may be placed lower.
4. ***Handrail.*** Use 1" x 6", 1" x 8", or 2" x 4".Place 42" above platform and nail on inside of upright.
5. ***Platform.*** 2" planks not less than 10" wide laid closely together. Planks to overlap at least 1'. Platforms to be 4' in width.
6. ***Crossbracing.*** Use 1" x 6" lumber or larger.
7. ***Footblocks and Sills.*** Use not less than 2" x 6". When uprights rest upon pavement or sidewalk, the sill should be continuous.
8. ***Toe-Board.*** 1" x 6"or wider.
9. ***Side Screens.*** If the material on the platform is piled higher than the toe-board one or more intermediate back rails should be added and ½" wire mesh or its equivalent should be provided between the top railing and the toe-board.
10. ***Concrete Buggies.*** Where concrete buggies are to be used on a scaffold, it should be designed to support a concentrated load of 500 lbs. on ledgers and planking, in addition to the normal scaffold loading.

*From *Manual of Accident Prevention in Construction.* Washington, DC: The Associated General Contractors of America, Inc., 1949.

Additional Information

For additional information about safety in use of ladders and scaffolding, you may wish to read:

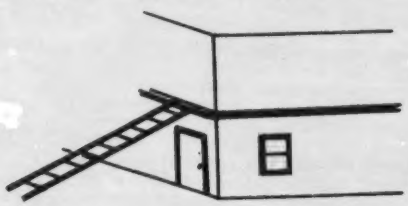
"Ladder and Scaffolding Safety" in the *Safety and Health Series.* Waco, TX: Center for Occupational Research and Development, 1982.

Manual of Accident Prevention in Construction. Washington, DC: The Associated General Contractors of America, Inc., 1949.

Self-Test Exercises

Read and answer the following questions. Check your answers with those in the Appendix. If you answer the items correctly, go on to the next chapter. If not, repeat your work in this chapter.

1. Critique the placement of the ladder in the figure below.



2. What are the specifications for using nails in scaffolding?
   Answer: _____
3. What means are available for securing a ladder at its base?
   Answer: _____

5. Using Protective Devices And Clothing

Chapter Overview

Purpose:	To develop knowledge of equipment and clothing used to protect against hazards in the work environment. An apprentice will learn the various types of protective equipment available, the hazards the devices protect against and some basic rules for equipment use and care.
Preassessment Score:	Write in the following space the number of correct answers from Pretest questions 16-20: _____. If you answered 5 of the questions correctly, skip to Posttest. If you missed any questions, work through this chapter.
Prerequisites:	Chapter 1 of this booklet.
Resources:	Time — about 60-90 minutes to complete. Materials — paper, pencil.
Performance Statement:	After completing your work in this chapter you will be able to identify appropriate devices and clothing to protect against work-related hazards.
Performance Measure:	A fifteen-minute paper and pencil Posttest to be taken after completing the entire booklet.
Standards:	To be successful, you must answer correctly 90% of the Posttest items.
Activities:	1. Read the text, examples and illustrations and commit information to memory. 2. Work exercises and answer questions. 3. Complete and check your answers on the Self-Test Exercises and the Posttest.

Introduction And Objectives

There are many cases where hazards cannot be removed from the job. A construction supervisor cannot remove the possibility of a worker stepping on a nail or getting bumped on the head with a beam. Similarly, the sparks and glare cannot be eliminated from the arc welder's job. In these and other instances, a worker must be protected against dangers with special protective equipment or clothing.

It is your employer's responsibility to assure that you are protected against hazards. But you also are responsible for wearing protective equipment as directed. That is the law. This chapter will introduce you to the types of protective equipment used on various jobs. After completing the chapter, you will be able to:

1. Recognize situations where protective equipment or clothing is needed to work safely.
2. Explain the hazards of not using protective devices or clothing properly.
3. Identify some of the types of protective clothing and equipment that are available for use.

Principles, Examples And Applications

Head Protection

An injury could occur to your head from a falling object, such as a tool or brick on a construction site. You could cut or bruise your head by bumping into a suspended object in an auto shop or many industrial settings. Other ways you can injure your head on the job are from shock, chemicals or burns. Because of the numerous hazards to your head and the seriousness of head injuries, workers in many jobs are required to wear protective headgear.

Hats and caps are available to protect your head, face, scalp, neck and hair. Some typical hard hats are pictured in Figure 3. The hats have straps that suspend the hat above your head. This suspension protects you from falling or moving objects by spreading the force over the entire area of your head. Hats can also be fitted with shields to protect the face, liners for work in cold weather, and chin straps to hold them securely in place. Aluminum hats are lighter than plastic, but do not protect as well against high impact. Hats with metal in them also do not protect against electric shock or some corrosive materials. Fabric caps are available that protect hair from dust, oil, sparks or from getting entangled in equipment. If you have long hair, this is an important consideration.

Inspect your hat each time you put it on. Make sure that the hat is suspended at least one and one-fourth inch above your head. Check the hat and the straps for cracks and wear, such as loose rivets, worn seams, or torn materials. You can wash most hats with warm, soapy water; then rinse and dry. Follow manufacturer's directions in using solvents to remove paint or other materials. Replace the sweatband as it becomes worn.

Eye And Face Protection

Eyes are particularly vulnerable to injuries in a shop or laboratory. Dust, wood or metal splinters, or other particles can become imbedded in the eye. Heat or chemical splashes can cause burns. Any of these hazards or blows to your eyes can cause permanent damage or even blindness. Because of the severity of accidents involving your eyes, wear eye protection even where the risk is slight. Eye protection should be worn at all times in the shop or laboratory and in many industrial settings. Contact lenses should *not* be worn where there is any risk of eye injury.

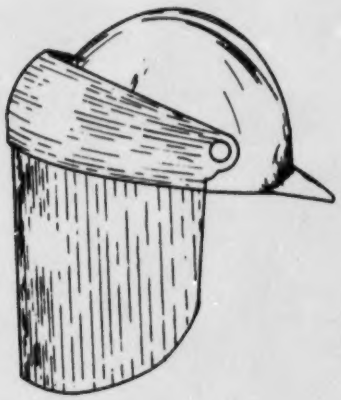
A number of different types of eye protection are available depending on the hazards you are exposed to. Some of these are pictured in Figure 4.

Safety Glasses

Safety glasses are similar in looks to regular eye glasses, but are designed with impact-resistant lenses and frames. They also are available with side shields, which protect against hazards from the

Plastic Cap

Aluminum Hat



Protective Hat with Face Shield

Figure 3: Protective Head Equipment

Safety Glasses

Goggles

Laboratory Goggles

Chipping Goggles

Welding Goggles

Welding Helmet

Face Shield

Figure 4: Face and Eye Protective Equipment

side. In most cases, glasses with side shields should be worn. Do not use glasses with clip-on side shields, because they easily can become detached.

Safety glasses protect against flying particles, such as dust, wood and metal slivers and other abrasives. If exposure is not too severe, they can be used for the following operations:

- Chipping
- Grinding
- Machining
- Spot welding (with tinted lenses)

Goggles

Goggles come in a number of forms to suit different eye protection needs. Standard goggles are made of a flexible or rigid plastic with a strap to hold them in place over your eyes. They have holes in the plastic for ventilation, since goggles do tend to fog up. The lenses also can be cleaned with defogging agents to help stop this problem.

Like safety glasses, goggles protect against flying particles in chipping, grinding, machining and spot welding operations. They provide somewhat more protection than safety glasses since they cover more of your face with no gaps. Goggles have the added advantage of being able to be worn over prescription eye glasses. However, they are not as comfortable as safety glasses, and become warm and steamy in a hot or humid environment.

Laboratory goggles differ from the standard shop goggles in that they have hooded ventilation. This allows air to circulate while preventing dangerous chemicals to enter through ventilation holes and cause injuries. Laboratory goggles should be worn in the laboratory or when handling chemicals. They protect against hazards such as chemical splash, acid burns, fumes which affect the eyes and glass breakage or other flying particles.

Chipping goggles give added protection against flying particles when the risk is severe, such as in some chipping and heavy grinding operations. They have contoured rigid eye cups which fit closely to the face. You can choose from two designs — one to wear over eye glasses and one to wear without eye glasses.

Welding Eye Protection

Both styles of chipping goggles can be used for acetylene burning, cutting and welding, *when fitted with tinted lenses*. This type of eye protection also can be used in furnace operations or working with molten metals. Specialized welding goggles, with a tinted plate lens as pictured in Figure 4, are also available for these operations. Welding goggles protect against sparks, harmful light rays, molten metal, flying particles, glare and heat.

Welding helmets offer the added protection required for arc welding. It is also recommended that you wear tinted safety glasses or goggles under the helmet. The helmet provides protection against sparks, intense light rays and molten metal.

Be sure to check with your supervisor that you have the correct type of filtered lens for the job you are on. Different types of welding, as well as the flux used and amount and temperature of the molten metal, emit different types of harmful rays. It is very important that you use the proper filter to protect your eyes against the hazards of the particular situation.

Face Shields

Face shields are shields connected to a head band to protect the face. They can be made of clear or tinted plastic, wire screen or a combination of materials. Generally, they are designed to flip up for close inspection of your work or when protection is not needed.

Face shields are used in combination with eye protection in a job where your face also is at risk. They can be designed to protect the crown or chin. This could be a situation where there is danger of splashing caustic materials and burning your face. Likewise, in heavy grinding or machining operations where flying particles could cut or bruise your face, a face shield is advised. They also can provide added protection against molten metals and sparks. Be sure to always wear eye protection behind the face shield.

Ear Protection

Your ears are vulnerable to a number of job hazards, most notably noise. If noise on the job is very loud, you feel pain and want to protect your ears. Noise of lower intensity can be dangerous also, even though the only thing you might feel is irritation because of the noise or being unable to communicate with co-workers. If you are exposed to the noise for long enough, it can cause temporary or permanent hearing loss. It can affect other parts of your body, too. Noise can cause nausea and reduced muscular control. This makes it difficult for you to perform your job well and could lead to an accident if your coordination is affected.

Devices are available to protect against noise and other hazards, such as flying particles, sparks or receiving a blow to the ear. There are two types of ear protectors, as shown in Figure 5. Ear plugs, which you insert into your ear canal, protect primarily against noise. Ear muffs protect against noise and impact.

Researchers have determined safe levels of exposure to noise. This is described in Table 3 as the number of hours per day you can be exposed to different sound levels without being injured. Decibels measure sound level or loudness, and can be determined using a sound level meter.

Ear protectors reduce the sound level to which you are exposed. Ear plugs, made out of rubber, plastic, or wax, can reduce the exposure by 25-35 decibels, depending on the type. Muffs can give 30-40 decibels of protection. Manufacturers report how much protection their equipment provides. Some guidelines for using ear protectors are:

- Choose a protector that is comfortable to wear and that provides adequate protection against noises in your work situation.
- Make sure they fit properly or you will not be getting the protection you should be.
- Wear them. If you do not wear the protectors all of the time, your protection is reduced substantially, much more than you would think.
- Do not over protect yourself. Often, you need to hear warnings or other information to perform your job properly and to avoid accidents.

Safety Clothing

Clothing offers protection on the job from such hazards as heat or cold, fire, dirt, chemicals, oils, and flying particles. In general, wear work clothes that is durable, comfortable, close-fitting and clean. Wear pants without cuffs and be sure they cover the tops of your shoes so that abrasive or caustic materials do not fall in your shoes. Specialized clothing may be required to protect against hazards in particular jobs:

- Flame retardant clothing — hot metal, sparks, flames.
- Short sleeves — hazards from working with power tools, equipment.
- Leather aprons or garments — heat, hot metal, impact, radiation.
- Plastic or rubber aprons or garments — chemicals, moisture, caustics, solvents.
- Metal reinforced aprons — blows to abdomen.

Ear Plugs

Ear Muffs

Figure 5: Ear Protective Equipment

Table 3**: Safe Exposure to Noise	
Duration Per Day (Hours)	**Sound Level (Decibels)**
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
¼	115*

*No safe exposure over 115 decibels.

**Standards of the National Institute for Occupational Safety and Health.

- Knee, shoulder, elbow, back pads — abrasions or bruises.
- High visibility clothing — hazards from working near highways, runways, large equipment or at night.

Gloves

Gloves may be required to protect your hands from job hazards. There are a number of different types of gloves (Figure 6) which you should wear depending upon the hazards you are exposed to, the finger dexterity or sensitivity you need to perform tasks and the areas of your hands and arms that need to be protected. The types of gloves appropriate for various work situations are listed below:

- Light work — canvas, cotton
- Handling abrasive materials — leather or reinforced light weight gloves
- Handling corrosive materials or oils — plastic, rubber
- Handling hot materials — leather, loop pile, aluminized, asbestos
- Welding — leather, gauntlet gloves

Do not wear gloves when working with machinery having moving parts.

Shoes

Safety shoes are designed to protect feet from falling or rolling objects, slipping, heat, spills, or shock. Often they are supplied by or through the company and are an important part of protecting yourself against injury. Depending on your work situation and company policy, select boots or shoes with any of the following design characteristics:

- durability
- acid resistance
- oil resistance
- nonconductivity
- conductive (to drain static)
- nonsparking
- nonslip
- cushioned soles
- heat resistance
- impact resistance (steel toes, instep protectors)
- puncture resistance (steel insole)

Some typical safety shoes are pictured in Figure 7.

Respiratory Protection

Respirators protect your lungs from particle-laden or toxic air which could cause temporary or permanent injury, disease or death. This could mean protecting you from a shop with too much dust in the air or providing you breathable air to work in an oxygen-deficient environment. Respirators also can be used to filter out certain toxic gases or particles.

Respirators fall into two major categories:

1. *Air purifying respirators.* Through filters or chemicals, these respirators remove toxic materials from the air. They are *not* for use where there is not enough oxygen in the air.
2. *Air supplied respirators.* These respirators provide breathable air to the user. They are for use in an oxygen-deficient environment (such as space) or situations with high concentrations of moving particles (abrasive blasting).

Figure 6: Gloves and Hand Protectors

Figure 7: Safety Shoes

If you have a need for a respirator, it will most likely be the first type, the air purifying respirator. These are used for activities such as spray painting, welding, using solvents, blasting, or sanding. Different types of air purifying respirators protect against different hazards. Be sure that you have the appropriate respirator for the job and that you are properly trained in its use. Check with your supervisor or with the equipment manufacturer to be sure. Otherwise, you may *not* be protected from serious dangers.

Three types of air purifying respirators are pictured in Figure 8. Also pictured is a dust mask, which protects against breathing dust or fiber particles. The uses of the different protectors are summarized in Table 4.

Table 4: Breathing Protectors

Protector	Sample Applications	Hazards Protected From
Dust Mask Particulate Respirator	Wood working Construction Brake work Blasting	Dust Fibers Wood/metal particles **Not** for dangerous fumes or lack of oxygen
Chemical Cartridge Respirator	Nonemergency situations Parts cleaning Welding Spray painting Working with chemicals	Organic vapors (carbon tetrachloride, gasoline, benzene, ether Dust, fog, smoke in combination with vapors Ammonia gas Mercury **Not** for carbon monoxide or lack of oxygen
Gas Mask	Emergency situations — more hazardous than those above, short-term use	Organic vapors Acid gas Ammonia gas Carbon monoxide Dust, fog, smoke in combination with gas or vapor **Not** for lack of oxygen

Additional Information

More information on protective equipment is contained in standards of the American National Standards Institute and the National Institute for Occupational Safety and Health. You may also refer to the following document:

National Safety Council. *Accident Prevention Manual for Industrial Occupations, Seventh Edition.* Chicago: National Safety Council, 1974.

Two sources that you should not overlook in being sure that you are using the proper equipment and using it correctly are your job supervisor and equipment manufacturers.

Disposable Dust Mask

Particulate Respirator

Chemical Cartridge Respirator

Gas Mask

Figure 8: Breathing Protectors

Self-Test Exercises

Read and answer the following questions. Check your answers with those in the Appendix. If you answer less than 7 items correctly, repeat your work in this chapter. If you score 7 or 8 correct answers, go on to the next chapter.

1. What are two hazards that are reasons for wearing a ...y hat?
   a. _____
   b. _____

2. When should you wear a face shield?
   Answer: _____
   _____

3. What are two sources of information on the proper uses of and how to use safety equipment?
   a. _____
   b. _____

List the type of equipment or clothing required for the following tasks:

4. Cleaning a magnetic head with carbon tetrachloride. _____
   _____

5. Operating a jack hammer. _____
   _____

6. Operating a lathe. _____
   _____

7. Carrying steel beams. _____
   and _____

8. Inspecting a construction site. _____
   _____ and _____

6. Appendix

Answers to Pretest

1. d
2. b
3. e, a, g, f, d, b, c
4. b
5. Above the 5th tier
6. The load should be evenly distributed from sides and located above the axles.
7. a. Your supervisor and b. manufacturer's operating instructions.
8. Wet objects conduct electricity better than dry objects, so you are in greater danger of shock.
9. You should have listed three of the following:
   a. That the motor is operating smoothly.
   b. That guards are in place and operating freely.
   c. That tools and equipment are clean, lubricated and sharpened.
   d. That controls operate and release correctly.
   e. That parts are not loose or missing.
   f. That the workhead moves freely by hand when unplugged.
   g. The condition of cords, plugs, and insulation for cracks, breaks, loose connections.
10. Turn off and uplug the tool or equipment.
11. Evaluate your work environment, tools, equipment and accidents that have occurred in the past. Make notes of hazards and keep them in the back of your mind so you are prepared.
12. At least 12"
13. d
14. c
15. a, b, c, d
16. b, e
17. Ear plugs or inserts; ear muffs
18. a
19. Hard hat and steel-toed and soled shoes or boots
20. Air purifying respirators remove toxic materials from the air. Air supplied respirators provide breathable air to the user in an oxygen-deficient environment or where there are high concentrations of moving particles.

Answers to Self-Text Exercises

Chapter 2: Handling and Storing Materials Safely

1. a. Size up load to determine weight and most advantageous way to lift.
   b. Assume comfortable stance with feet close to load.

c. Crouch close to load with knees bent and back straight.
d. Grasp load, take deep breath and tuck chin.
e. Rise slowly, lifting load by straightening legs.
f. Hold load close to body and move with weight evenly distributed.
g. Place load on floor or platform in manner similar to that of pick-up.

2. a. Hands, arms, shoes for grease or moisture.
b. Materials for sharp or jagged edges.
c. Surface for unevenness, rough or slick spots.
d. Clearance of materials through area of move.
e. The floor or surface space where you will move the load.
3. 10 layers high
4. Shock loads and the angle at which the sling is tied.
5. Loose or ill-fitting clothing.
6. Behind the equipment and always uphill.

Chapter 3: Using Tools and Equipment Safely

1. Moving parts and electrical shock.
2. Any three of the following: wet environment; no ground connections; improper size fuse; damaged insulation; tool not double insulated.
3. Any three of the following items: motor operation; guards in place and working; clean,
5. lubricated and sharpened; conditions of parts; controls; work head; and parts.
6. Develop awareness of risks and hazards.
7. Learn to operate, adjust and maintain tools and equipment safely.
8. Be alert.

Chapter 4: Using Ladders and Scaffolding Safely

1. Strengths: Ladder does not appear to be defective as a tool.
Limitations: Angle of base is too great (or base is too far from wall); not enough overhang at top; there is no visible securing of base of ladder; the ladder is placed in front of door.
2. Drive nails home and use cut nails where possible.
3. Safety feet; nailing; tying; butting against cleat; holding ladder.

Chapter 5: Using Protective Devices and Clothing

1. Any two of the following items: falling objects; suspended objects; shocks; chemicals; burns.
2. When your face is in danger from flying particles, caustic materials, molten metals or sparks.
3. a. Job supervisor.
b. Equipment manufacturer.
4. Chemical cartridge respirator
5. Ear protector (plugs or muffs)
6. Eye protector (safety glasses or goggles)
7. Instep protectors and gloves or palm pads
8. Hard hat and safety shoes. Depending on the operations, eye protectors may be required.

Posttest

Directions: *Answer the following questions. After completing all questions, check your answers with the answers that follow. If you score 90% or better, you have completed successfully Basic Safety II. If you score less than 90%, repeat the portion of the module with which you had difficulty.*

1. The major cause of injury associated with moving materials is:
   a. scraping knuckles because of load size, whether carrying a load or using a hand truck.
   b. having a load shift and fall, either smashing toes or straining muscles.
   c. abrasions caused by snagging clothing on moving equipment like conveyors.
   d. trying to lift too heavy a load and straining back.

2. List in order the steps in moving a load manually:
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____
   f. _____
   g. _____

3. Why is it important to crouch or squat when picking up or placing an object on the ground?
   Answer: _____

4. Stacked sacks of materials should never be piled above how many layers? Answer: _____

5. What five things should you check before lifting a load to move?
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____

6. List three safeguards against electrical shock from power tools and equipment:
   a. _____
   b. _____
   c. _____

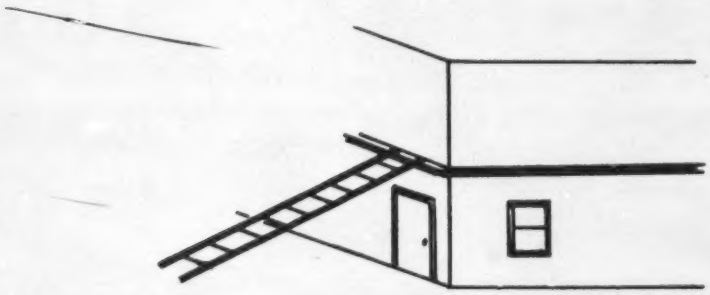
7. Why should you always put tools away in a proper storage place when finished with them?
   Answer: _____
   _____
   _____

8. Which of the following is *not* a safety guideline for using tools and equipment:
   a. Maintain tools and make minor repairs as directed by your supervisor or manufacturer's instructions.
   b. Keep power cords off the floor by coiling and hanging on a nail on the wall.
   c. Transport tools in a box, cart, belt or pouch.
   d. Use a tool with a proper size and duty rating for the job.

9. What is the purpose of machine guards?
   Answer: _____
   _____

10. List three steps to develop safety skills in working with tools and equipment:
    a. _____
    b. _____
    c. _____

11. Examine the following picture and point out the safety hazards that are illustrated.
12.



13. What is the general rule for overlap of extension ladders?
    Answer: _____

14. Scaffolds should be designed and built to support at least _____ times the weight they are expected to hold.

15. Guard rails and toeboards should be used on all scaffolds. OSHA standards require that they be used on structures above how many feet?
    Answer: _____

16. What special clothing or equipment is required for arc welding?
    Answer: _____, _____, and _____.

17. How do laboratory goggles differ from shop goggles?
    Answer: _____
    _____

18. What sound level in decibels is safe for a worker to be exposed to for 8 hours per day?
    Answer: _____

19. List three hazards that safety shoes are designed to protect against:
    a. _____
    b. _____
    c. _____

20. When would you need a particulate respirator?
    Answer: _____
    _____

Answers to Posttest

1. d

2. a. Size-up load to determine approximate weight and most desirable lift point.
   b. Assume comfortable position with feet close to load and slightly staggered.
   c. Crouch or squat close to load with knees bent and back straight.
   d. Grasp load securely, take and hold deep breath and tuck chin.
   e. Rise slowly, lifting the load by straightening your legs with stress on legs and shoulders.
   f. Hold load close to body with weight evenly distributed.
   g. Return load to floor or platform in similar fashion to that of picking-up load.
   (Count 1 point for first 3 items and a second point for remaining 4 items. Total of 2 points.)

3. The idea is to make your leg and shoulder muscles do the work, *not* your back.

4. Ten layers high

5. a. Hands, arms and shoes for moisture and grease
   b. Materials for jagged and sharp edges
   c. Surface of floor for rough, slick or uneven areas
   d. Area through which to carry load for clearance
   e. Spot where load will be placed for debris
   (Count 1 point for first 2 items and a second point for remaining 3 items. Total of 2 points.)

6. a. Ground wire
   b. Low voltage
   c. Double insulated construction
   (Count 1 point for first items and 1 additional point for next 2 items. Total of 2 points.)

7. They could be used by an untrained worker. They could get in someone else's way.

8. b

9. To protect the worker from mechanical hazards.

10. a. Develop an awareness of the risks and hazards.
    b. Learn to operate, adjust and maintain tools and equipment safely.
    c. Be alert.
    (Count 1 point for first correct answer and a second point for the next 2 items. Total of 2 points.)

11. a. base is too far from wall (angle is not great enough);
12. b. extension above wall is too small (less than 36″);
    c. ladder in front of door;
    d. the base of the ladder is not secured;
    e. the bottom is not barricaded or identified.
    (Score 1 point for getting 3 or 4 correct; score 2 points for getting 5 correct.)

13. About 10 percent of the height of the extension ladder is included in the overlap therefore, 3′ on a 36′ ladder; 4′ on a 40′ ladder and 5′ on a 48′ ladder are in the overlap.
    (Count 1 point for 1 length and a second point for all 3 lengths. Total of 2 points.)

14. 4 to 5 times the anticipated weight

15. 10′

16. Welding helmet, gloves and apron

17. The ventillation on laboratory goggles is hooded so that caustic materials cannot enter.

18. 90 decibels

19. Any three of the following:
    a. Falling or rolling objects
    b. Slipping
    c. Heat
    d. Spills
    e. Shock
    (Count 1 point for first correct answer and 1 point for next 2 correct. Total of 2 points.)

20. When the air is laden with irritating particles such as dust; fibers; wood, metal, or stone particles.

Scoring:

Questions #1, 3, 4, 7, 8, 9, 11, 12, 14, 15, 17, 18 and 20 each count 1 point. Questions #2, 5, 6, 10, 13 and 19 each count 2 points, one for each of the parts as indicated on the answer sheet.

You must score a minimum of 22 points to complete your work in this module successfully. If necessary, repeat your work in various chapters of this booklet.